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EXAMINER	
THOMPSON, JAMES A	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 09/688,610	Applicant(s) DONOVAN ET AL.	
	Examiner James A. Thompson	Art Unit 2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28 and 34-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28 and 34-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 October 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 21 March 2007 has been entered.

Response to Arguments

2. Applicant's arguments filed 21 March 2007 have been fully considered by Examiner and are addressed below. The previous prior art rejections have been withdrawn, but new grounds of rejection are presented in the present office action.

Regarding page 24, line 2 to page 25, line 20: The present amendments to the claims have overcome the previous prior art rejections. The present amendments to the claims are fully addressed in the new prior art rejections set forth below.

Regarding page 25, line 22 to end of page 46: Applicant makes four primary arguments in this section of Applicant's Arguments, which Examiner will address in turn. Applicant argues: (1) Curry (USPN 5,410,414) and Koike (USPN 5,988,790) are functionally incompatible, and are therefore not combinable; (2) Curry is not an enabled or feasible reference; (3) Curry establishes but does not modify a tabulation; and (4) Curry does not correct mark intensity, as now specifically recited *via* the present amendments to the claims.

(1) Applicant argues that Curry and Koike are functionally incompatible, and therefore not combinable [page 25, line 22 to page 27, line 3; page 35, line 23 to page 36, line 28; page 40, line 5 to end of page 46]:

Examiner accepts and concedes Applicant's analysis of the incompatibility of attempting to combine the ink jet system taught by Koike with the hyperacuity printing system of Curry. Based on Applicant's analysis and Examiner's subsequent reconsideration of the references, Examiner accepts that the hyperacuity printing taught by Curry, along with the necessary phase and positioning control, would not be properly applicable in an ink jet printing environment.

<u>(2) Applicant argues that Curry is not an enabled or feasible reference [page 36, line 30 to page 40, line 4]:</u>

Firstly, Curry is an issued patent, and is therefore presumed valid [see MPEP §1701]. However, as noted above, Examiner has accepted Applicant's arguments that Curry and Koike are incompatible and thus not properly combinable.

<u>(3) Applicant argues that Curry *establishes* but does not *modify* a tabulation, (4) nor does Curry correct mark intensity, as now specifically recited *via* the present amendments to the claims [page 27, line 5 to page 35, line 21]:</u>

Examiner accepts, based on Applicant's arguments, that Curry does not teach modifying, without entirely replacing, a preexisting multi-column, multi-row numerical tabulation used to correct mark intensity errors, as now required by the independent claims.

Regarding page 47, line 1 to page 52, line 2: Examiner has fully considered Applicant's remarks with respect to various other claims and outstanding rejections under 35 USC §103(a). Since the combination of Curry and Koike has been shown to be untenable, the remaining rejections under 35 USC §103(a) are withdrawn. However, based on the presently amended claims, new rejections under 35 USC §102(a) and 35 USC §103(a), which require new combinations of references, are presented in the present office action.

<u>Conclusion:</u> Based on Applicant's present arguments, the rejections under 35 USC §103(a) set forth in the previous office action mailed 17 November 2006 are withdrawn. New prior art rejections are set forth below, and are based upon both previously cited prior art and additional prior art that has been discovered during the normal course of examination.

Claim Rejections – 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 3 and 4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.** The limitation "the optical density transformation" is recited in line 3 of each of claim 3 and claim 4. There is insufficient antecedent basis for this recitation in either claim.

Claim Rejections – 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

6. **Claims 1, 6, 8, 25, 28, 34, 36-38 and 40-42 are rejected under 35 U.S.C. 102(a) as being anticipated by Koike (US Patent 5,988,790).**

Regarding claim 1: Koike discloses an apparatus comprising, for each colorant, at least one multi-element printing array (figure 6; figure 7a; and column 11, lines 35-40 of Koike – *printing array can be adapted for color printing, and thus be organized as multiple printing arrays, one for each colorant*) that is subject to mark-intensity errors of individual printing elements (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*); means (figure 8 and column 12, lines 62-67 of Koike) for modifying, without entirely replacing, a pre-existing multi-column, multi-row numerical tabulation that defines an intensity correspondence between such input image data and such marks, to compensate for the measured mark-intensity errors (column 12, line 67 to column 13, line 11 and column 14, lines 3-34 of Koike – *tabulation corresponds to dot size instructions for each nozzle, which will in general be different for each nozzle based on the determined modifications*); and means for printing using the modified tabulation (column 14, lines 11-12 lines 37-43 of Koike).

Regarding claim 6: Koike discloses that the measuring means comprises means for measuring mark intensity error for one or more groups of printing elements (grouped by lines), each group being fewer than all of the elements, of each multi-element printing array respectively (figure 7a and column 12, lines 37-48 of Koike); and the modifying means comprises means for applying the respective mark-intensity error, for at least one of the multi-element printing arrays, to modify a respective said tabulation (column 12, lines 37-48 of Koike – *modification of dot diameter performed with respect to line number of print nozzle*).

Regarding claim 8: Koike discloses that the measuring means comprises means for measuring mark-intensity error for individual printing elements, individually, of at least one of the multi-element printing arrays, respectively (column 14, lines 3-17 and lines 31-43 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); the modifying means comprises: means for deriving a correction pattern from the measured mark-intensity error, and means for applying the correction pattern to modify the tabulation (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified to obtain best quality hardcopy print*).

Regarding claim 25: Koike discloses a method comprising measuring mark intensity error (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*); and, based on the measured mark intensity error, compensating for the intensity error without modifying position of particular marks relative to such pixel grid, or to any ideal form of such pixel grid (column 12, lines 31-53 of Koike – *dot diameter is adjusted to compensate for mark intensity error, and not position of any mark*).

Regarding claim 28: Koike discloses that the measuring step comprises measuring mark-intensity error of printing elements considered as groups, said groups being fewer than all the printing elements for any given color (figures 7a-7b and column 12, lines 34-42 of Koike – *printing elements grouped according to print lines to correct for mark-intensity error*).

Regarding claim 34: Koike discloses an apparatus comprising at least one multi-element incremental printing array (figure 6; figure 7a; and column 11, lines 35-40 of Koike – *ink jet nozzle printing is incremental*) that is subject to colorant-deposition error, including error in mark intensity of individual printing elements (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*), considered individually (column 14, lines 31-37 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); means for measuring mark-intensity error of the at least one array (figure 7a and column 12, lines 37-48 of Koike); means (figure 8 and column 12, lines 62-67 of Koike) for modifying a multi-column, multi-row numerical tabulation which forms an intensity relationship between such input image data and such marks, to compensate for the measured mark-intensity error (column 12, line 67 to column 13, line 11 and column 14, lines 3-34 of Koike – *tabulation corresponds to dot size instructions for each nozzle, which will in general be different for each nozzle based on the determined modifications*); means for printing using the

modified tabulation (column 14, lines 11-12 lines 37-43 of Koike), wherein the printing array is an inkjet printhead (column 8, lines 46-49 of Koike).

Regarding claim 36: Koike discloses measuring a parameter (α) related to print-quality defects due to departure of print medium advance from an optimum value (column 12, lines 34-49 and column 14, lines 31-43 of Koike); based on the measured parameter, scaling such input image data to compensate for said departure (column 12, lines 34-49 of Koike – *dot sizes scaled based on amount of print line widening or narrowing*); and printing such image using the scaled input image data (column 14, lines 11-12 lines 37-43 of Koike), wherein the multi-element printing array is an inkjet printhead (column 8, lines 46-49 of Koike).

Regarding claim 37: Koike disclose an apparatus comprising: for each colorant, respective means for printing incrementally in that colorant (figure 6; figure 7a; and column 11, lines 35-40 of Koike – *printing array can be adapted for color printing, and thus be organized as multiple printing arrays, one for each colorant – ink jet nozzle printing is incremental*); each said printing means, for a particular one colorant, comprising at least one respective incremental-printing array (figure 6; figure 7a; and column 11, lines 35-40 of Koike – *printing array can be adapted for color printing, and thus be organized as multiple printing arrays, one for each colorant – ink jet nozzle printing is incremental*) that is subject to colorant-deposition error, including error in mark intensity of individual printing elements (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*), considered individually (column 14, lines 31-37 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); means for measuring mark intensity error of the at least one array (column 14, lines 3-17 and lines 31-43 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); means (figure 8 and column 12, lines 62-67 of Koike) for modifying a multi-column, multi-row numerical tabulation that forms an intensity relationship between such input image data and such marks, to compensate for the measured error in mark intensity (column 12, line 67 to column 13, line 11 and column 14, lines 3-34 of Koike – *tabulation corresponds to dot size instructions for each nozzle, which will in general be different for each nozzle based on the determined modifications*), wherein the numerical tabulation is not a halftone screen (*tabulation is dot size instructions for each nozzle, as noted above, and not a halftone screen*); and means for printing using the modified tabulation (column 14, lines 11-12 lines 37-43 of Koike).

Regarding claim 38: Koike discloses an apparatus comprising at least one multihundred-element (column 11, lines 35-38 of Koike – *any values of k, N and P can be selected, so k, N and P can be selected such that there are multihundred elements*) printing array (figure 6; figure 7a; and column 11, lines 35-40 of Koike) that is subject to colorant-deposition error, including error in mark intensity of individual printing elements (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*), considered individually (column 14, lines 31-37 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); means (figure 8 and column 12, lines 62-67 of Koike) for modifying a multi-column, multi-row numerical tabulation that forms an intensity relationship between such input image data and such marks, to compensate for the measured error in mark intensity (column 12, line 67 to column 13, line 11 and column 14, lines 3-34 of Koike – *tabulation corresponds to dot size instructions for each nozzle, which will in general be different for each nozzle based on the determined modifications*); and means for printing using the modified tabulation (column 14, lines 11-12 lines 37-43 of Koike).

Regarding claim 40: Koike discloses an apparatus comprising at least one multi-element incremental printing array (figure 6; figure 7a; and column 11, lines 35-40 of Koike – *ink jet nozzle printing is incremental*), having at least thirty printing elements (column 11, lines 35-38 of Koike – *any values of k, N and P can be selected, so k, N and P can be selected such that there are at least thirty elements*), that is subject to colorant-deposition error, including error in mark intensity of individual printing elements (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*), considered individually (column 14, lines 31-37 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); means for measuring intensity error of the at least one array (column 14, lines 3-17 and lines 31-43 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); means (figure 8 and column 12, lines 62-67 of Koike) for modifying a multi-column, multi-row numerical tabulation which forms an intensity relationship between such input image data and such marks, to compensate for the measured error in mark intensity (column 12, line 67 to column 13, line 11 and column 14, lines 3-34 of Koike – *tabulation corresponds to dot size instructions for each nozzle, which will in general be different for each nozzle based on the determined modifications*); and means for printing using the modified tabulation (column 14, lines 11-12 lines 37-43 of Koike).

Regarding claim 41: Koike discloses that the at least one multi-element incremental printing array comprises a scanning printhead or a full-page-width printhead (figures 10, 11a and 11b; and column 15, lines 29-40 of Koike).

Regarding claim 42: Koike discloses that the printing means comprises at least one microprocessor controlling all of the at least thirty elements simultaneously during printing (figure 3(12) and column 9, lines 47-53 of Koike) to select, and selectively actuate, particular elements for printing of particular pixels respectively (figures 10, 11a and 11b; and column 15, lines 32-45 of Koike).

Claim Rejections – 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 2-3, 5, 7, 9, 11-15, 18, 22-23, 35 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view Obata (US Patent 6,172,700 B1).

Regarding claim 2: Koike does not disclose expressly that the apparatus has printing resolution on the order of 450 marks per inch; and the apparatus has mark positioning addressability on the order of 450 marks per inch.

Obata discloses an apparatus having a printing resolution on the order of 450 marks per inch and a mark positioning addressability on the order of 450 marks per inch (column 5, lines 53-60 of Obata – *400 dpi is on the order of 450 marks per inch – each LED used for printing must be addressable in order to print a dot*).

Koike and Obata are combinable because they are from the same field of endeavor, namely the correction of arrays of printing elements *via* element dot size alteration. At the time of the invention, it would have been obvious to one of ordinary skill in the art to specifically use an apparatus which has a printing resolution and mark positioning addressability of 400 dpi, which is on the order of 450 marks per inch. The suggestion for doing so would have been that a 400 dpi hardcopy document is typical in the art for printed documents. Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 2.

Regarding claim 3: Koike does not disclose expressly that the optical-density transformation comprises a rendition-thresholding dither matrix.

Obata discloses optical-density transformation (printing of halftone data values using halftone dots) based on a rendition-thresholding dither matrix (column 9, lines 9-16 of Obata – *halftoning inherently requires a rendition-thresholding dither matrix in order to output halftoned data onto a hardcopy*).

Koike and Obata are combinable because they are from the same field of endeavor, namely the correction of arrays of printing elements *via* element dot size alteration. At the time of the invention, it would have been obvious to one of ordinary skill in the art to specifically use halftone thresholding for determining dot print positions. The suggestion for doing so would have been that halftone dot generation is standard for producing grayscale image levels in a hardcopy output. Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 3.

Regarding claim 5: Koike discloses that the number of individual marking elements in use, divided by the number of rows in the tabulation, equals an integer (figure 7a of Koike – *in example, number of individual marking elements equals seven times number of rows in the tabulation, so number of individual marking elements divided by number of rows in tabulation equals seven*); the tabulation is one- or two-dimensional only (figure 7a and column 14, lines 31-37 of Koike – *tabulation instructs dot size changes based on determinations made from test print – tabulation one- or two-dimensional only, as shown based on the two-dimensional nozzle layout of figure 7a of Koike, although given the dot order 1-6 one could also consider the two-dimensional tabulation to be one-dimensional*); for at least one of the plurality of multi-element printing arrays, the mark-intensity error comprises a respective pattern of printing-intensity defects (figures 7a-7b and column 12, lines 34-49 of Koike – *pattern causing streaks based on feed error*); the measuring means comprises means for measuring the pattern of mark-intensity defects for each multi-element printing array respectively (column 12, lines 49-53 of Koike – *measured dot size adjustment values performed so as to correct for streak pattern*); and the modifying means comprises means for applying the respective pattern of defects, for at least one of the multi-element printing arrays, to modify a respective said tabulation (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are modified to prevent streaking artifacts*).

Regarding claim 7: Koike discloses that the mark intensity error comprises a pattern of printing density defects (figures 7a-7b and column 12, lines 34-49 of Koike – *pattern causing streaks based on feed error*); the measuring means comprises means for measuring the pattern of printing-density defects (column 12, lines 49-53 of Koike – *measured dot size adjustment values performed so as to correct for*

streak pattern); the modifying means comprise: means for deriving a correction pattern from the measured pattern of printing-density defects, and means for applying the correction pattern to modify a dot printing process (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified to prevent streaking artifacts*); and for each colorant (column 11, lines 35-40 of Koike – *printing array can be adapted for color printing, and thus be organized as multiple printing arrays, one for each colorant*), the printing means comprises means for printing such image incrementally, using the modified dot printing process (figure 7a-7b and column 12, lines 54-58 of Koike – *incrementally printed according to line number*).

Koike does not disclose expressly that said dot printing process is specifically a halftone printing process.

Obata discloses printing using a halftone printing process (column 9, lines 9-16 of Obata).

Koike and Obata are combinable because they are from the same field of endeavor, namely the correction of arrays of printing elements *via* element dot size alteration. At the time of the invention, it would have been obvious to one of ordinary skill in the art to specifically use halftone thresholding for determining dot print positions. The suggestion for doing so would have been that halftone dot generation is standard for producing grayscale image levels in a hardcopy output. Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 7.

Regarding claim 9: Koike discloses a method comprising measuring mark intensity error (column 12, lines 31-53 and column 14, lines 31-43 of Koike – *dot diameter, and thus mark intensity, needs to be changed to prevent errors related to streaking*); deriving a correction pattern from the measured error in intensity (figure 7a and column 12, lines 49-53 of Koike – *dot size changes derived for pattern of printing nozzles*); applying the intensity-error correction pattern to correct the error, by modifying a dot printing process (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified to obtain best quality hardcopy print*) that uses a predefined numerical array of dot size values (figure 7a; column 11, lines 35-38; and column 14, lines 31-43 of Koike – *dot size adjustment performed for each nozzle, set of nozzles for an array*); wherein the applying step comprises preparing a modified form of the predefined numerical array, based upon the intensity-error correction pattern, and then using that modified form of the array (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified for each nozzle (and thus the predefined numerical array) to obtain best quality hardcopy print*); and for each colorant (column 11, lines 35-40 of Koike – *printing array can be adapted for color printing, and thus be organized as multiple printing arrays, one for each colorant*), printing such image by said at least one

multi-element printing array respectively, using the dot printing process modified on the basis of the intensity-error correction pattern (column 12, lines 54-58 and column 14, lines 37-43 of Koike).

Koike does not disclose expressly that said dot printing process is specifically a halftone threshold process that uses a halftone matrix which is a predefined numerical array.

Obata discloses printing using a halftone threshold process that uses a halftone matrix which is a predefined numerical array (column 9, lines 9-16 of Obata – *halftoning inherently includes some form of thresholding*).

Koike and Obata are combinable because they are from the same field of endeavor, namely the correction of arrays of printing elements *via* element dot size alteration. At the time of the invention, it would have been obvious to one of ordinary skill in the art to specifically use halftone thresholding for determining dot print positions. The suggestion for doing so would have been that halftone dot generation is standard for producing grayscale image levels in a hardcopy output. Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 9.

Regarding claim 11: Koike discloses that the printing step comprises cooperation between plural printing elements that mark in a single common color, to form marks that together define a single common small region of such image, in said common color (figure 7a and column 12, lines 34-42 of Koike – *individual nozzles in a line are modified in alternating pattern, and lines of nozzles cooperate to eliminate streaking artifacts*).

Regarding claim 12: The method taught by Koike comprises no positional-error feedback to modify positional addressing of image data in relation to the pixel grid since the error feedback is based on dot diameter, and not dot position (column 12, lines 31-53 of Koike – *dot diameter is adjusted to compensate for mark intensity error, and not position of any mark*).

Regarding claim 13: Koike discloses that the measuring, deriving, applying and printing steps are performed based on the local line printing characteristics of a multi-element printing array (figures 7a-7b and column 12, lines 34-53 of Koike), and thus the measuring, deriving, applying and printing steps are performed with respect to each multi-element printing array, respectively.

Regarding claim 14: Koike discloses that the measuring, deriving, applying and printing steps are also employed to modify swath height of at least one of the multi-element printing arrays, for accommodating any swath-height error present in each multi-element printing array respectively (figures 7a-7b and column 4, lines 34-49 of Koike – *streaks caused by error in line-to-line print nozzle feeding, and thus swath height*).

Further regarding claim 15: Obata discloses that the image is printed using a halftone thresholding process (column 9, lines 9-16 of Obata – *thresholding inherent part of halftoning*). Thus, the halftone thresholding process comprises definition of a halftone matrix since a halftone matrix is inherent to a halftone thresholding process.

Further regarding claim 18: Obata discloses that the applying step comprises replacing error diffusion or halftoning threshold values above or below a particular value (column 10, lines 35-55 of Obata – *image data thresholded and corrected differently based on preselected amounts*).

Regarding claim 22: Koike discloses that for each of the plurality of multi-element arrays, the measuring, deriving and applying steps are performed at most only one time for a full image (figure 9 and column 14, lines 27-36 of Koike –*full test image has only one set of test data for the steps of measuring, deriving and applying*).

Regarding claim 23: Koike discloses that the printing elements have a spacing along the array (figure 4 and column 11, lines 35-38 of Koike); and the printing step proceeds with a positioning precision and addressability that is coarser than or equal to said printing-element spacing along the array (figure 7a and column 12, lines 34-40 of Koike – *spacing is wider, and thus coarser, in region that needs correction*).

Regarding claim 35: Koike discloses a method comprising: measuring error in mark density (column 12, lines 49-53 of Koike – *measured dot size adjustment values performed so as to correct for streak pattern*); deriving a correction pattern from the measured mark-intensity error (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified to prevent streaking artifacts*); applying the correction pattern to modify a dot printing process (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified to obtain best quality hardcopy print*) that uses a predefined numerical array of dot size values (figure 7a; column 11, lines 35-38; and column 14, lines 31-43 of Koike – *dot size adjustment performed for each nozzle, set of nozzles for an array*), wherein the applying step comprises preparing a modified form of the predefined numerical array, and then using that modified form of the array to correct the mark intensity (column 12, lines 49-53 and column 14, lines 31-34 of Koike – *dot size adjustment values are derived and modified for each nozzle (and thus the predefined numerical array) to obtain best quality hardcopy print*); and for each colorant (column 11, lines 35-40 of Koike –*printing array can be adapted for color printing, and thus be organized as multiple printing arrays, one for each colorant*); and printing such image using the modified dot printing process (column 12, lines 54-58 and column 14, lines 37-43 of Koike), wherein the multi-element printing array is an inkjet printhead (column 8, lines 46-49 of Koike).

Koike does not disclose expressly that said dot printing process is specifically a halftone printing process.

Obata discloses printing using a halftone printing process (column 9, lines 9-16 of Obata).

Koike and Obata are combinable because they are from the same field of endeavor, namely the correction of arrays of printing elements *via* element dot size alteration. At the time of the invention, it would have been obvious to one of ordinary skill in the art to specifically use halftone thresholding for determining dot print positions. The suggestion for doing so would have been that halftone dot generation is standard for producing grayscale image levels in a hardcopy output. Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 35.

Regarding claim 39: The printer of Koike is an inkjet printer (column 8, lines 46-49 of Koike), and is thus incapable of hyperacuity printing. Koike discloses that the apparatus further comprises means for measuring intensity error of the at least one array (column 14, lines 3-17 and lines 31-43 of Koike – *dot size altered and measured for each individual printing element in the multi-element print array to determine best size for printing*); and the multihundred-element printing array has at least three hundred printing elements (column 11, lines 35-38 of Koike – *any values of k, N and P can be selected, so k, N and P can be selected such that the number of elements is at least three hundred).*

Koike does not disclose expressly that the apparatus has printing resolution on the order of 450 marks per inch; and the apparatus has mark positioning addressability on the order of 450 marks per inch, or less, along at least one axis.

Obata discloses an apparatus having a printing resolution on the order of 450 marks per inch and a mark positioning addressability on the order of 450 marks per inch, or less, along at least one axis (column 5, lines 53-60 of Obata – *400 dpi is on the order of 450 marks per inch – each LED used for printing must be addressable in order to print a dot*).

Koike and Obata are combinable because they are from the same field of endeavor, namely the correction of arrays of printing elements *via* element dot size alteration. At the time of the invention, it would have been obvious to one of ordinary skill in the art to specifically use an apparatus which has a printing resolution and mark positioning addressability of 400 dpi, which is on the order of 450 marks per inch. The suggestion for doing so would have been that a 400 dpi hardcopy document is typical in the art for printed documents. Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 39.

9. Claims 4, 16-17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view Obata (US Patent 6,172,700 B1) and Kobayashi (US Patent 6,333,793 B1).

Regarding claim 4: Koike in view of Obata does not disclose expressly that the optical-density transformation comprises an error-diffusion thresholding hierarchy.

Kobayashi discloses an error-diffusion thresholding hierarchy for generating gray-scale halftone image data (column 6, lines 15-26 of Kobayashi).

Koike in view of Obata is combinable with Kobayashi because they are from the same field of endeavor, namely image data quality control and correction in digital color image printing systems. At the time of the invention, it would have been obvious to one of ordinary skill in the art to apply error diffusion processing. The motivation for doing so would have been to obtain improved image quality (column 3, lines 60-64 of Kobayashi). Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 4.

Regarding claim 16: Koike in view of Obata does not disclose expressly that the halftone thresholding process comprises an error-diffusion protocol.

Kobayashi discloses an error-diffusion thresholding protocol for generating gray-scale halftone image data (column 6, lines 15-26 of Kobayashi).

Koike in view of Obata is combinable with Kobayashi because they are from the same field of endeavor, namely image data quality control and correction in digital color image printing systems. At the time of the invention, it would have been obvious to one of ordinary skill in the art to apply error diffusion processing. The motivation for doing so would have been to obtain improved image quality (column 3, lines 60-64 of Kobayashi). Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 16.

Further regarding claim 17: Kobayashi discloses that the error diffusion protocol comprises at least one of: a progressive error-distribution allocation protocol of such error-diffusion halftoning (column 6, lines 26-36 of Kobayashi); and a decisional protocol for determining whether to mark a particular pixel (column 6, lines 19-21 of Kobayashi).

Regarding claim 19: Koike in view of Obata does not disclose expressly that the applying step comprises multiplying error diffusion or halftoning threshold values by a linear factor.

Kobayashi discloses multiplying error diffusion or halftoning threshold values by a linear factor (column 6, lines 26-36 of Kobayashi – *error diffusion values are multiplied by a linear weighting factor*).

Koike in view of Obata is combinable with Kobayashi because they are from the same field of endeavor, namely image data quality control and correction in digital color image printing systems. At the time of the invention, it would have been obvious to one of ordinary skill in the art to apply error diffusion processing. The motivation for doing so would have been to obtain improved image quality (column 3, lines 60-64 of Kobayashi). Therefore, it would have been obvious to combine Obata with Koike to obtain the invention as specified in claim 19.

10. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view Obata (US Patent 6,172,700 B1) and Mantell (US Patent 5,731,827).

Regarding claim 10: Koike in view of Obata does not disclose expressly using a printmask, said printmask being a defined system of numerical values, distinct from the measured pattern of defects and distinct from the derived correction pattern, that establishes the printing pass in which each ink mark is to be made, to determine a relationship between the halftone matrix and the multi-element printing array; and employing the relationship in the applying step to control application of the correction pattern to the halftone matrix.

Mantell discloses using a printmask, said printmask being a defined system of numerical values (column 10, lines 1-10 of Mantell), distinct from the measured pattern of defects and distinct from the derived correction pattern, that establishes the printing pass in which each ink mark is to be made, to determine a relationship between the halftone matrix and the printing array (column 10, lines 1-10 of Mantell); and employing the relationship in the applying step to control application of the correction pattern to the halftone matrix (column 10, lines 11-19 of Mantell). By combination with the teachings of Koike in view of Obata, each printing array is a multi-element printing array. Furthermore, by applying the printmask taught by Mantell, the application of the correction pattern to the halftone matrix taught by Koike in view of Obata is controlled.

Koike in view of Obata is combinable with Mantell because they are from similar problem solving areas, namely controlling print spot order and positions to improve print image quality. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use multi-pass printing, including the associated print mask, as taught by Mantell. The motivations for doing so would have been to allow the ink to dry during passes, to be able to mask the printhead signature, and to be able to print ink-saving draft print modes (column 10, lines 2-7 of Mantell). Therefore, it would have been obvious to combine Mantell with Koike in view of Obata to obtain the invention as specified in claim 10.

11. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view Obata (US Patent 6,172,700 B1) and Imao (US Patent 5,436,739).

Regarding claim 20: Koike in view of Obata does not disclose expressly that the applying step comprises applying a gamma correction function to error diffusion or halftoning threshold values.

Imao discloses applying a gamma correction function to error diffusion or halftoning threshold values (column 4, lines 33-40 of Imao – *applied to halftoning threshold values*).

Koike in view of Obata is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply a gamma correction function to the halftoning threshold values. The motivation for doing so would have been to be able to eliminate non-linearities in the image data (column 3, lines 67-68 of Imao). Therefore, it would have been obvious to combine Imao with Koike in view of Imao to obtain the invention as specified in claim 20.

Further regarding claim 21: Obata discloses replacing error diffusion or halftoning threshold values above or below a particular value (column 10, lines 35-55 of Obata – *image data thresholded and corrected differently based on preselected amounts*).

Koike in view of Obata does not disclose expressly that the modifying step comprises a combination of at least two of said replacing step taught by Obata; multiplying each error diffusion or halftoning threshold value by a linear factor; and applying a gamma correction function to error diffusion or halftoning threshold values.

Imao discloses applying a gamma correction function to error diffusion or halftoning threshold values (column 4, lines 33-40 of Imao – *applied to halftoning threshold values*).

Koike in view of Obata is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply a gamma correction function to the halftoning threshold values. Thus, by combination, the modifying step comprises a combination of at least two of said replacing, multiplying and applying steps. The motivation for doing so would have been to be able to eliminate non-linearities in the image data (column 3, lines 67-68 of Imao). Therefore, it would have been obvious to combine Imao with Koike in view of Obata to obtain the invention as specified in claim 21.

12. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view Obata (US Patent 6,172,700 B1) and Drake (US Patent 6,089,693).

Regarding claim 24: Koike in view of Obata does not disclose expressly that the applying step comprises modifying the average number of marks printed by an individual printing element whose mark intensity is defective.

Drake discloses modifying the average number of marks printed by an individual printing element whose mark intensity is defective (figure 3(70) and column 5, lines 33-43 of Drake).

Koike in view of Obata is combinable with Drake because they are from the same field of endeavor, namely control and correction of printer dot marking in digital image data printing systems. At the time of the invention, it would have been obvious to one of ordinary skill in the art to provide for correction in the event of nozzle defects, as taught by Drake. The motivation for doing so would have been to effectively correct for the visible and objectionable printing artifacts that occur due to printing nozzle defects (column 5, lines 11-32 of Drake). Therefore, it would have been obvious to combine Drake with Koike in view of Obata to obtain the invention as specified in claim 24.

13. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view of Surbrook (US Patent 4,924,301).

Regarding claim 26: Koike discloses scanning multi-element printing arrays that are at least two in number (column 11, lines 35-40 of Koike – *color printing require at least two, usually at least three, multi-element printing arrays*); and that, aside from linear alignment, no step of the method is directed to regularizing the pixel grids to one another or to such ideal form (column 11, lines 35-40 of Koike – *multi-element printing naturally adaptable to color printing, thus each color is not shown to be processed in any way with respect to each other*).

Koike does not disclose expressly that each printing array forms a pixel grid that is at least partially different from a pixel grid formed by each other printing array, and from any ideal form of such pixel grid.

Surbrook discloses a plurality of printing arrays, each corresponding to a different color, wherein each printing array forms a pixel grid that is at least partially different from a pixel grid formed by each other printing array, and from any ideal form of such pixel grid (figures 3A-3D and column 15, lines 52-58 of Surbrook – *each pixel grid different according to angle of pixel grid*).

Koike and Surbrook are combinable because they are from the same field of endeavor, namely digital color printing. At the time of the invention, it would have been obvious to one of ordinary skill in

the art to use different halftone screen angles for each color separation that is printed. The motivation for doing so would have been to reduce the occurrence of color printing artifacts (column 15, lines 34-43 of Surbrook). Therefore, it would have been obvious to combine Surbrook with Koike to obtain the invention as specified in claim 26.

14. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US Patent 5,988,790) in view of Tatsuta (US Patent 5,943,448).

Regarding claim 27: Koike does not disclose expressly that the compensating step comprises the step of adjusting thresholds of a pre-existing tabulation that forms a relationship between said input image data and the individual printed marks, wherein said threshold adjusting step statistically increases or reduces usage of printing elements associated with said mark-intensity error, thereby increasing or decreasing total numbers of marks in image regions associated with those printing elements.

Tatsuta discloses adjusting thresholds of a pre-existing tabulation that forms a relationship between the input image data and the individual printed marks (figure 5 and column 15, lines 4-17 of Tatsuta), wherein said threshold adjusting step statistically increases or reduces usage of printing elements associated with said mark-intensity error, thereby increasing or decreasing total numbers of marks in image regions associated with those printing elements (*a change in threshold relationship tabulation between input image data and individual printed marks will inherently statistically increase or reduce usage of printing elements associated with mark-intensity error, thereby increasing or decreasing total numbers of marks in image regions associated with those printing elements*).

Koike in view of Tatsuta are combinable because they are from the same problem solving area, namely the control of print dot size in digital image data printing systems. At the time of the invention, it would have been obvious to one of ordinary skill in the art to adjust the thresholds used for determining printing or not printing at each nozzle location. The suggestion for doing so would have been that changing threshold values also changes the dot size (see figure 5 of Tatsuta), which is a desired result in Tatsuta. Therefore, it would have been obvious to one of ordinary skill in the art to combine Tatsuta with Koike to obtain the invention as specified in claim 27.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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